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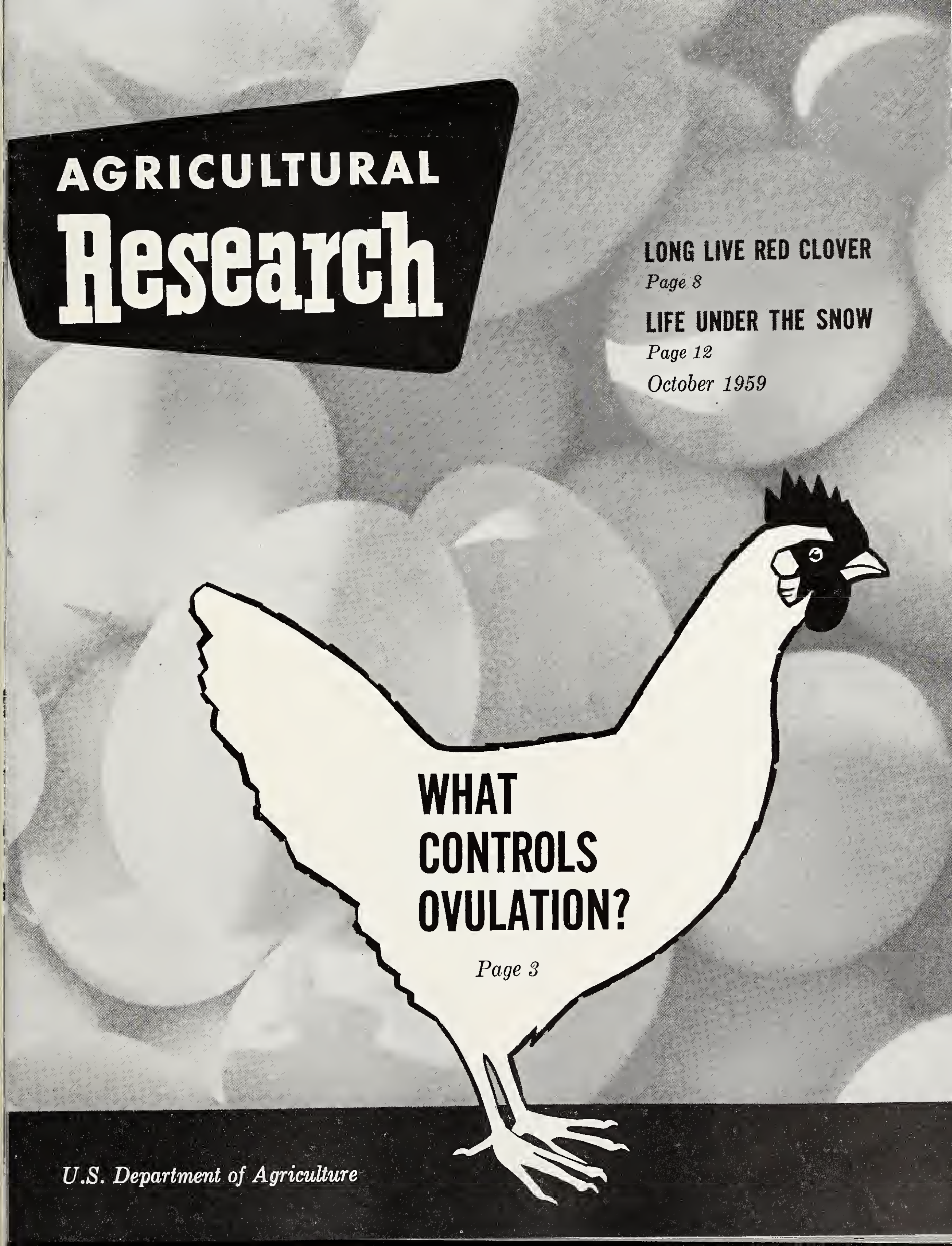

WHAT CONTROLS OVULATION?

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Look Ahead

Farmers are producing plenty now, but how much are we going to ask them to grow in another 15—or 50—years?

They face a big job. Our population passed 177 million earlier this year. Census projections indicate that we may have as many as 230 million people by 1975, perhaps even more.

So, say our economists, farmers will have to produce an average of 35 to 45 percent more to meet the needs of 1975.

They can do it, of course. The question is, What will it cost in natural resources and in labor and capital?

We could bring more land into production. But it will probably be more economic to get the gains from wider application of present technology and further research advances.

In 1956, we met our needs with 506 million acres of cropland equivalent (that's total acreage in crops, plus cropland-equivalent acreage in less productive pasture). In terms of 1956 yields and practices, we will need 714 million acres to meet the needs of 1975—an increase of 208 million acres.

Only about 25 million of those acres are likely to come from developing new cropland through drainage, clearing woodland, irrigation, and improving ranges. The big share will come from putting present knowledge to use—this will give increases equal to the production from 160 million acres. New techniques, from research of the next 5 years, should provide increases equivalent to the output of the other 23 million acres.

This means we must devise improvements 30 percent faster than we did during the fruitful 20 years preceding 1956.

But even more formidable is the job beyond. The Census Bureau estimates that by the year 2010 we may have 370 million people—more than double our present population. More than a billion acres of land would be needed in terms of today's production methods. Our present goal is to develop a technology equivalent to 400 million acres of additional land.

To do that will require improvements in farm practices at a rate 160 percent as great as in the last two decades.

This calls for strengthening our agricultural research at every stage—from refining new techniques almost ready for release to pushing fundamental studies of natural phenomena.

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AGRICULTURAL RESEARCH SERVI[CE]
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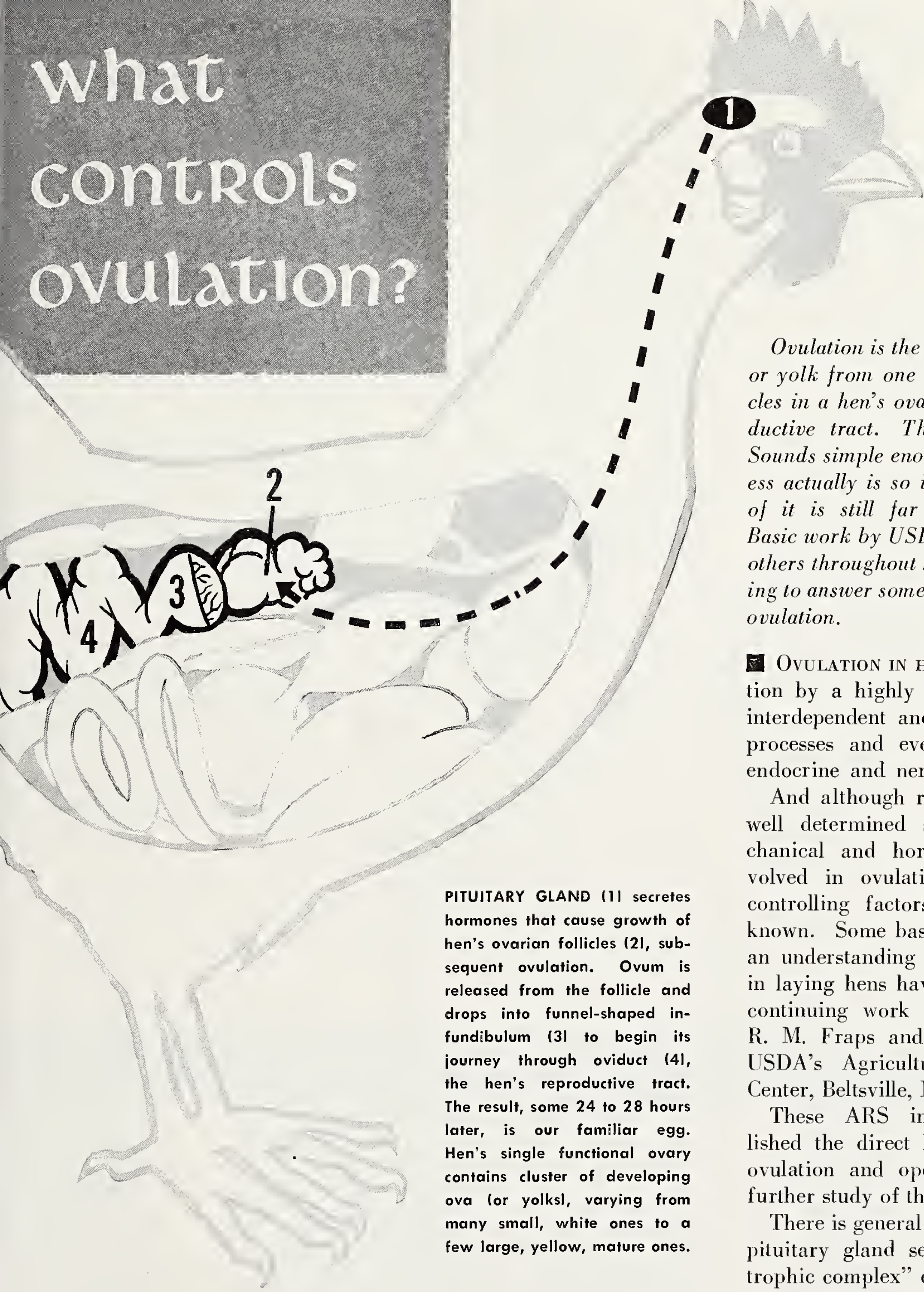
what controls ovulation?



PITUITARY GLAND (1) secretes hormones that cause growth of hen's ovarian follicles (2), subsequent ovulation. Ovum is released from the follicle and drops into funnel-shaped infundibulum (3) to begin its journey through oviduct (4), the hen's reproductive tract. The result, some 24 to 28 hours later, is our familiar egg. Hen's single functional ovary contains cluster of developing ova (or yolks), varying from many small, white ones to a few large, yellow, mature ones.

Investigators have established a hormonal basis for this complex process, are now studying nervous factors controlling release of hormones

Ovulation is the release of an ovum or yolk from one of the saclike follicles in a hen's ovary, into her reproductive tract. The result: an egg. Sounds simple enough—but the process actually is so intricate that much of it is still far from understood. Basic work by USDA researchers and others throughout the country is helping to answer some of the mysteries of ovulation.

■ OVULATION IN HENS is set into motion by a highly complex series of interdependent and accurately timed processes and events involving the endocrine and nervous systems.

And although research has pretty well determined some of the mechanical and hormonal factors involved in ovulation, many of the controlling factors still remain unknown. Some basic contributions to an understanding of these processes in laying hens have come out of the continuing work of endocrinologist R. M. Fraps and his coworkers at USDA's Agricultural Research Center, Beltsville, Md.

These ARS investigators established the direct hormonal basis of ovulation and opened the way for further study of this process.

There is general agreement that the pituitary gland secretes a "gonadotrophic complex" consisting of a follicle-stimulating hormone (FSH) and a luteinizing hormone (LH). FSH causes growth and maturation of the ovarian follicles; LH causes rupture of the mature follicle.

TURN PAGE

WHAT CONTROLS OVULATION?

(Continued)

Early work at Beltsville proved ovulation could be induced, or advanced up to 30 hours, by injecting extracts containing LH. It was also shown that hens whose pituitaries were removed 4 to 6 hours before expected ovulation failed to ovulate.

Moreover, it was found possible to increase the number of eggs laid successively by LH injections, although the yolks became smaller.

Release of the hormones is apparently controlled by a nervous mechanism involving the hypothalamus and perhaps other regions of the brain.

Egg laying, of course, is the natural consequence of ovulation. Much of what we know about ovulation has come from a detailed study of egg laying patterns and records of lay.

Under normal lighting, most birds lay in a characteristic pattern. A bird may lay one or more eggs a day for several days, then miss a day, and resume laying at approximately the same rate as before. A busy hen may lay an egg a day for 50 or even 100 consecutive days in what's known as a sequence or clutch.

The first ovulation after a period of lapse generally occurs early in the morning and almost never after 2 or 3 o'clock in the afternoon. Since it takes 24 to 28 hours for egg formation, and ovulation occurs within 30 to 60 minutes after the preceding egg is laid (except for the last egg in a cycle), a hen ovulates later each day. When ovulation fails to take place late on a given day, the hen usually begins a new and similar cycle early the next morning.

Actual time of day when ovulation occurs depends on the prevailing photoperiodicity (hours of light out of 24), sequence length, and when a follicle matures in a sequence, since ovulation occurs with follicle rupture. Thus, a hen ovulating the first ovum of a moderately long sequence at 6 a.m. will probably lay her egg at about 9 a.m. the next day.

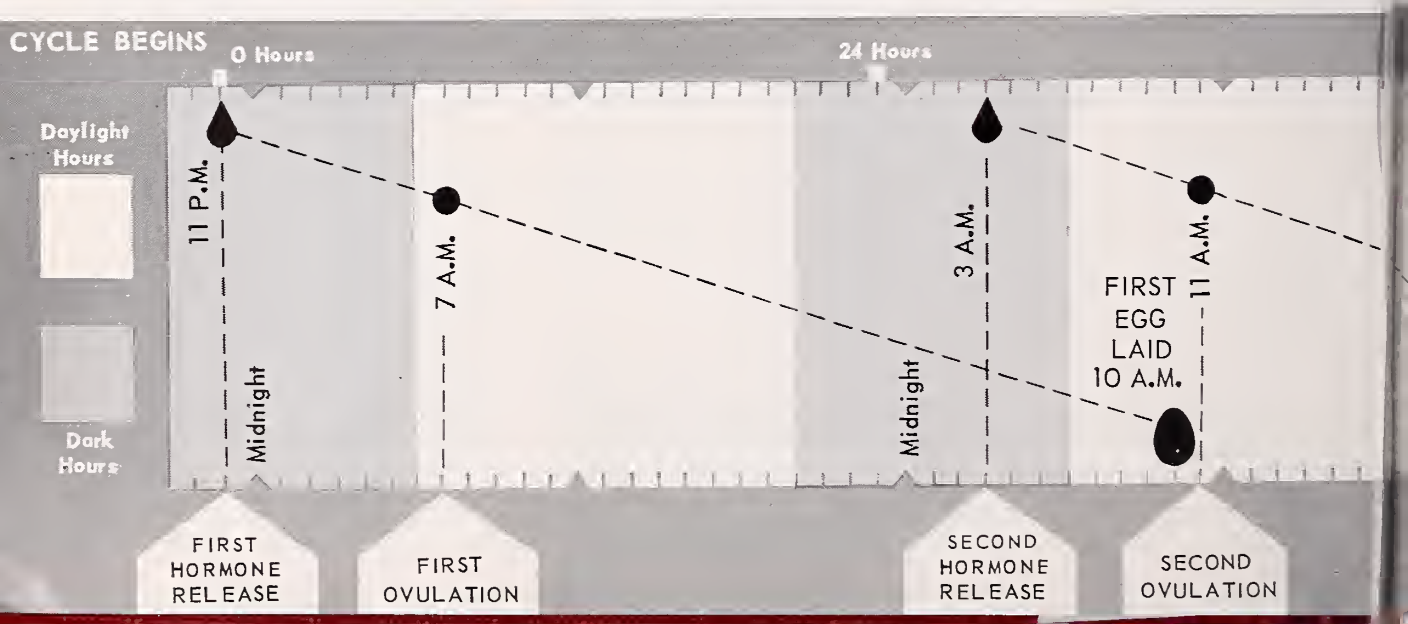
A hen's productivity is usually determined by the length of her laying cycle. And this in turn depends on the interval between successive ovulations. The longer this interval, the fewer eggs in one sequence, and the less productive the bird. The interval between successive ovulations is less, on the average, in high-producing hens.

Some investigators now believe there is a continuous "flow" of FSH, and a smaller flow of LH, from the pituitary gland to maintain follicular growth. Rate of flow is apparently inherent in a bird. A high rate means she has a longer egg-laying cycle; a low rate, a shorter cycle.

Ovulation is actually caused by the timed release of LH, or perhaps of the gonadotrophic complex. Studies at Illinois suggest that the contents of the magnum, where the albumen is laid down, or of the isthmus, where the shell membranes are formed, prevent release of LH through a nervous mechanism. Specific drugs known to block nervous mechanisms also interrupt the periodic release of LH.

That a high degree of synchronization is necessary for reproduction in the hen is by now well established, although not completely understood. Current studies along these lines at Beltsville are devoted to an understanding of nervous factors controlling the release of the reproductive hormones from the pituitary gland. Studies are also underway on the effect of environmental factors on follicular growth and ovulation. ☆

A 3-DAY OVULATION CYCLE, simplified: Hormone release and ovulation occur on 2 successive days, resulting in laying of eggs. On third day, or day of lapse, no hormone is released and ovulation fails to occur. New and similar cycle begins next day. Intervals between hormone release and ovulation, between ovulation and laying, aren't always this precise; photoperiod (amount of daylight) is probably most important of factors involved.



Mature follicle. Contains ovum.

Ruptured follicle. Ovum released.

Infundibulum. Engulfs ovum, which remains here about 20 minutes.

Magnum. Most of egg protein is stored in this highly glandular area. Cells are thought to secrete mucin, responsible for egg albumen. Ovum stays here about 3 hours. Magnum is longest part of oviduct, measuring some 33 centimeters in length.

Isthmus. Peristaltic movements of magnum force ovum into isthmus, where inner and outer shell membranes are formed. Ovum remains here about 1½ hours.

Uterus. Ovum remains here some 18 to 22 hours, receiving a shell, shell pigments, water, and salts.

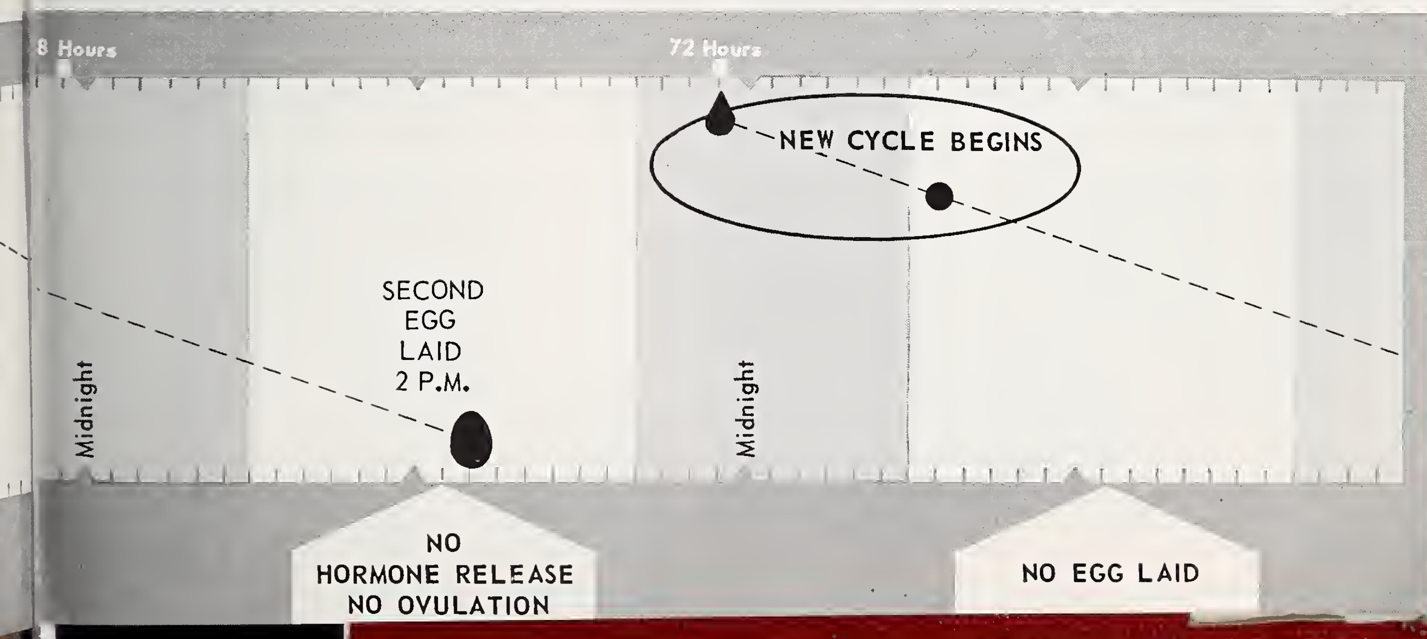
Vagina. Contraction of uterus forces egg out through vagina.

Cloaca.

REPRODUCTIVE TRACT of HEN

Ovary. Follicle-stimulating hormone (FSH) from pituitary gland causes growth of ovum and enveloping follicle. When ovum is mature, ovulation occurs under control of luteinizing hormone (LH). Ruptured follicle has just released its ovum. Time of most recent follicle rupture influences time when next egg is expelled.

Mature follicle. Network of blood vessels shows. Rupture occurs along stigma—clear area in center. Just before ovulation, vessels get prominent, then blur. Stigma distorts or bulges (indicating internal pressure), membrane breaks, releasing ovum.



Pioneering studies of chemical and physical nature of viruses, their reproduction method, and their varied effects are bringing

PLANT VIRUSES UNDER NEW ATTACK

■ PLANT VIRUSES, which cause major crop diseases, are coming under intensive study at USDA's new Pioneering Research Laboratory in Plant Virology.

The laboratory, 1 of 15 ARS basic research groups now in operation, is under the leadership of botanist R. L. Steere, formerly with the University of California Virus Laboratory. Plant pathologists H. A. Scott, T. O. Diener, and H. H. McKinney (retired but collaborating with USDA), and a biochemist to be appointed complete the group at the Beltsville, Md., laboratory.

Part of the research will be aimed at learning how viruses reproduce within host plants—the chemical and physical nature of the conversion of host plant constituents into virus particles. Such studies on viruses—considered to be the smallest and, as far as is known, the least complex of all living organisms—may provide valuable information on the chemical basis of life.

The electron microscope, which makes it possible to see the otherwise invisible viruses, will be used to study reproduction. And attempts will be made, with improved techniques, to show more definitively the actual shapes of virus particles and to work out a system to distinguish viruses on the basis of structure.

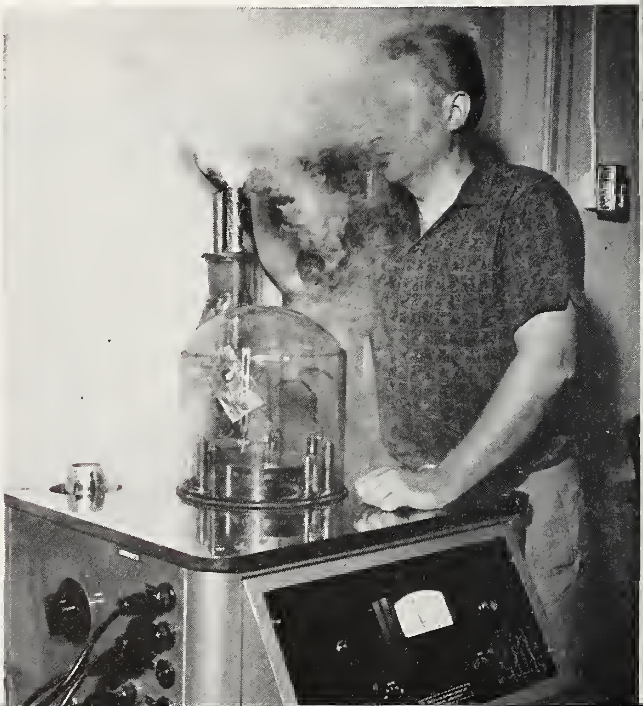
Other studies will deal with the chemical composition of viruses, differences between them, and the chemical basis of symptom expression in host plants. For instance, why and how does one virus cause mosaic or ringspot patterns on leaves, but another cause the development of adventitious branches called witches' brooms?

The scientists will also try to develop serological and chemical techniques for detecting virus infections in the early stage. A method for early detection is greatly needed, especially to prevent the spread of virus diseases among vegetatively propagated plants such as fruit trees, berry bushes, potatoes, and sweetpotatoes. These plants may not show symptoms of infection until several months or years after propagation.

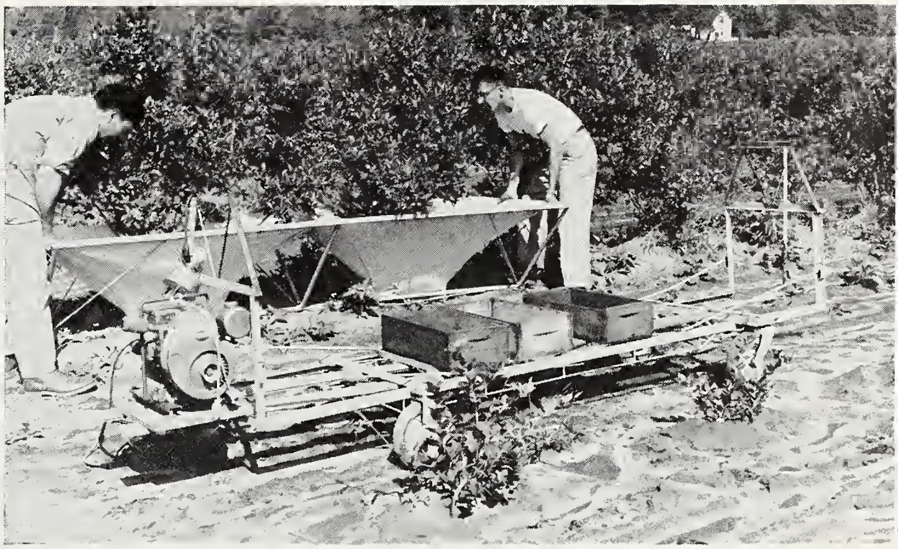
Steere and his group are beginning work on the aster-yellows virus and related viruses, strains of which infect probably the widest range of hosts of all known plant viruses. Hosts include such varied crops as lettuce, rice, spinach, potato, tomato, celery, bean, cantaloup, flax, blueberry, peach, garden plants, and the China aster, from which the virus derives its name. ☆

TO INFECT common host plantain with aster-yellows virus, Steere encloses leafhopper vectors in cage (made of test tube and nylon stocking) and attaches cage to leaf.

LIQUID nitrogen poured into one tube in vacuum chamber acts as moisture condenser to dry frozen virus on another tube, a step in preparing specimen for electron microscope.



ECTRIC VIBRATOR held against cane loosens
rries. They drop into cloth collector.



COLLECTING UNIT is placed under two bushes; semicircular cutouts permit snug fit. Gas-powered generator and boxes for picked fruit are transported on cart.

Mechanizing the Blueberry Harvest

Experimental devices may end costly handpicking, relieve growers' dependence on plentiful labor, and prevent loss of unpicked crops

MECHANICAL HARVESTING AIDS promise a faster, lower cost, and bigger harvest of blueberries. Thousands of pounds are lost yearly because f a shortage of labor to harvest the largely handpicked crop.

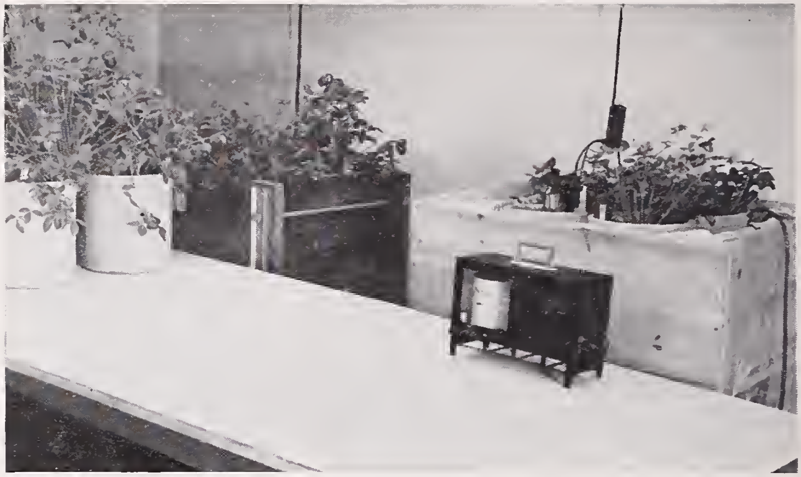
Now under test by USDA and the Michigan Agricultural Experiment tation, in cooperation with growers and processors, are devices that nable a picker to harvest three times as many berries per hour as he an pick by hand. The aids are an electric vibrator to shake berries rom bushes, a two-bush berry collector, and a pneumatic sorter.

In experiments made last year in Michigan by ARS agricultural engineers S. L. Hedden and J. H. Levin and horticulturist H. P. Gaston joint employee of ARS and the Michigan station), the aids enabled ach picker to pick 28 pounds of berries per hour. An hourly average f only 9 pounds was picked by hand. Mechanical harvesting costs vere 3½ cents a pound. Handpicking costs averaged 8 cents. Two vorkers, each using a vibrator and a two-bush collector, could harvest 2,500 pounds of berries in 30 days. The pneumatic sorter, operated y one worker, has a capacity of at least 500 pounds per hour.

The experimental vibrator, converted from an electric hoe, has rubber-covered fingers that are held against the branches. The rectangular ollector, made of cloth attached to a tubular metal frame, is moved long one side of a row, then the other side. The sorter is made of galvanized sheet metal. It separates trash and small, unripe berries y means of an airblast that carries away this lighter material.

The aids should prove as effective in the major production areas of Maine, New Jersey, Oregon, and Washington as in Michigan. ☆

PNEUMATIC SORTER is next for blueberries. An airblast separates trash and small, unripe berries from sound fruit. Good berries pass through machine and into boxes at left. Machine cleans 500 pounds of fruit per hour.



INTERACTING effect of disease and temperature on root food reserves is studied by growing healthy and diseased plants at root temperatures varying from 55° to 95° F. in controlled environment chamber.

FIELD plants were cut one or more times, then grown in dark chamber. Plants on bottom shelf, given most cuttings, show least growth because of low food reserves in roots.

LONG LIVE RED CLOV

This perennial lasts only 1 year—exhausts root reserves after mowing or seed set and dies—but better recovering selections promise true perenniality

■ WHAT MAKES A PERENNIAL PLANT act like an annual or a biennial? Our scientists are trying to find out why red clover, botanically a perennial plant, in some areas dies when stands are only 1 or 2 years old.

Basic studies on the physiology of red clover are being made by USDA in cooperation with the Kentucky Agricultural Experiment Station, Lexington. The studies are expected to provide a basis for breeding to obtain longer living and more productive red clover. Breeding work has the additional goal of developing varieties that are resistant to a number of diseases.

Whether red clover is grown for hay, pasture, or seed. the plants don't live as long as perennials should. After being grazed or mowed, clover must exist and begin new growth on food stored in the roots. If there isn't enough food reserve in the roots, or if the reserve is used up by respiration (the biological breakdown of food to produce energy) before regrowth and photosynthesis resume, the plants will die.

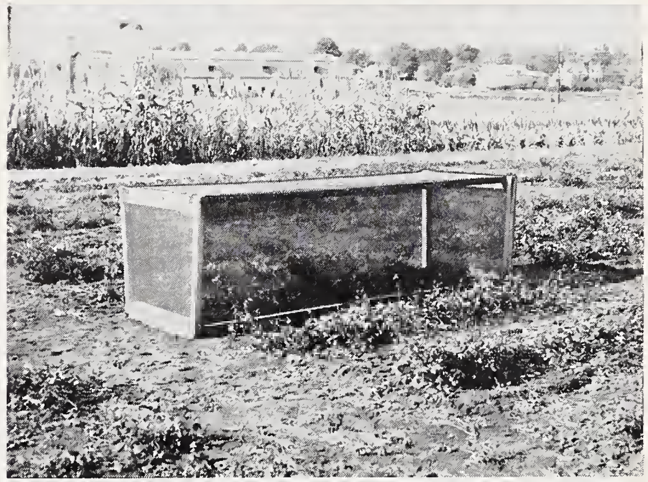
A known influence on respiration rate is temperature. The higher the temperature, the faster food is used up. Two experiments by ARS plant physiologist W. A. Kendall showed high temperature can kill clover after harvest through quick depletion of food reserves.

Kendall grew groups of red clover plants at relatively hot, mild, and cool temperatures. After sufficient growth, the tops were clipped and some plants were rotated to different temperature treatments. The temperature at which plants were grown *before* clipping had no apparent effect on survival. But *after* clipping, plants kept at 95° F. had the highest mortality rate.

Food reserves depleted at high temperatures

The next experiment related death at a high temperature to depletion of food reserves. One group of clipped plants was grown at 95° F. during the day and 80° F. at night, and another group at 75° and 60° F., respectively. Analysis at harvest and at 5, 10, 15, and 20 days after harvest showed that the plants grown at high temperatures continuously decreased in available carbohydrate up to 20 days after harvest. But after an initial decrease, the plants grown at low temperatures began to show gains 15 days after clipping.

The plant's stage of development was found in another



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CLONES selected for longevity are increased vegetatively in field. Plant breeder Taylor (right, above) points out selection still showing vigorous, persistent growth. Individual line (right, below) is enclosed in screened cage for seed increase to protect it from crosspollination with other lines.

experiment to affect the *amount* of stored food. It had long been suspected that seed setting in red clover occurred at the expense of further vegetative growth. Kendall and E. A. Hollowell, leader of ARS clover studies, compared plants having only vegetative growth with plants at the bud stage, in flower, and with seed set. The researchers found that plants that had set seed had much less reserve food in their roots than did plants in the vegetative state. Plants in the bud stage had as much reserve food as vegetative plants.

Some clipped plants from each group were grown in dark chambers so that growth and survival depended solely on use of carbohydrate reserves in the roots. Those plants in the vegetative state initiated top growth faster, suggesting a better chance for survival.

Effects of environment and disease studied

Tests of survival in the dark chamber of clover grown in field plots for hay, seed, or pasture have thus far shown no clearcut relation between management practices and survival, but the occurrence of disease in fields may obscure this relationship. Other tests are being made to check the effect of interaction of environmental factors and disease on root food reserves.

Long-living selections are used in breeding

Efforts to obtain longer living, disease-resistant plants began some years ago when plant pathologist L. Henson of the Kentucky station developed a high degree of resistance to southern anthracnose in Kenland red clover. Breeding to obtain longer living clover is being continued. Kentucky plant breeder N. L. Taylor, cooperating with ARS, started in 1955 with selections from Kenland clover plants that had survived 3 years.

Selections were increased vegetatively and clones allowed to crosspollinate. producing polycross seed. This seed was used as a progeny test of the original clones and a basis for selecting clones genetically capable of transmitting persistence. Selected clones will then be intercrossed to form a synthetic variety with a more dependable perennial habit. With the information on temperature and survival, selections can be screened for tolerance to high temperature. Taylor is also screening for resistance to mildew and virus diseases. ☆

For Aromatic Tobacco: ELECTRIC CURING

CURING BARN, 10 x 20 x 10 feet, has capacity for 1 acre of leaf tobacco. Two resistance heaters (5,000-watt potential) and forced air system gave quality curing for 8 years with saving of labor.

EIGHT-INCH DUCT has air-control damper and electric heater at each register. Six units served curing barn 12 x 22 x 12 feet.

■ Aromatic tobacco grows well in western Virginia and the Carolinas. But sun-and-air curing—traditional in the native Mediterranean areas—is risky in the variable climate of our own production areas.

USDA-State cooperative engineering studies with two Virginia farmers are showing how standby electric heat in the curing barn eliminates weather risks and helps produce high-quality, high-value cured aromatic leaf. The curing tobacco, ranged on racks, can be moved outdoors in the sun and air in favorable weather. Tobacco can also be left to cure in the barn in some weather without using heat. But the proper environment can be created indoors by insulating the barn and equipping it with automatically controlled electric heaters and circulating fans to use when they're needed.

Aromatic tobacco is a relatively new crop in this country, and engineering studies by ARS and the Virginia Agricultural Experiment Station are adding to our knowledge of equipment and structures needed for curing. Research on electric systems has shown them feasible as a source of forced air and standby heat, the two musts in curing top-quality aromatic tobacco under weather conditions that may prevail where we grow it.

Natural curing supplemented by electric heat when needed costs about 10 percent of the crop's value. This is relatively inexpensive. since aromatic tobacco brings a high price of about 80 cents a pound.

Production of aromatic tobacco in the United States is still quite limited, averaging about 1 million pounds a year. We imported about 105 million pounds in 1958, mostly for blending in cigarette tobaccos. ☆

SEEDS BAGGED TO KEEP

■ Seeds being shipped to the tropics may soon travel in new hot-weather-style plastic bags. Limited USDA tests recently showed that polyethylene bags protect seeds from damaging effects of high tropical humidity.

Seeds of kenaf—a fiber crop grown in Southeast Asia and parts of Latin America—were dried to a safe moisture content and placed in 5- and 10-mil-thick polyethylene bags. After 15 months' storage in a Cuban warehouse, the seeds were still highly viable. In contrast, kenaf seeds stored in cloth bags, the standard practice, were practically worthless.

Shipment of seed to or through tropical countries presents special difficulties because seed moisture increases so rapidly due to the high humidity. To overcome this problem, ARS scientists at the Agricultural Research Center, Beltsville, Md., decided to test the usefulness of several plastics—5- and 10-mil polyethylene, and a cellophane laminated between sheets of 2-mil polyethylene. Seeds were also placed in cloth bags.

Six bags of each of these materials were filled with kenaf seeds and sent to Cuba for storage. After 3, 15, and 27 months, bags were returned and the seed tested for moisture and germination. Seeds were similarly bagged and stored in a Beltsville laboratory for the same periods.

Seed moisture increased somewhat in the Cuban-stored plastic bags. Loss of germination in seed shipped to Cuba and returned was in proportion to the increase in seed moisture. The greater moisture increase, the faster germination decreased.

The protection afforded by the polyethylene bags was effective only

after seeds were stored for *more* than 3 months in Cuba. Seeds in both polyethylene bags were highly viable after 15 months' storage.

After 27 months' storage, however, viability of seeds even in the polyethylene bags was too low for practical use. But the additional protection of 10-mil polyethylene after 27 months was evident in the higher germination—53 percent compared with 7 percent for seeds in the 5-mil polyethylene bag, and 1 percent for the seeds in laminated cellophane.

Kenaf seeds stored in the laminated bags deteriorated faster at all times than those in the polyethylene bags. And the seeds in the cloth bags were worthless for planting after only 15 months' storage.

Seeds stored in Beltsville under moderate moisture conditions weren't greatly affected. Only the seeds held in a cloth bag showed a clearcut loss in viability after 27 months.

Scientists believe the polyethylene plastics are useful for shipment and short-time storage of seeds such as kenaf in the tropics. But these materials aren't sufficiently moisture-resistant in hot humid weather to protect kenaf seeds for more than about 15 months. ☆

PUTTING FERTILIZER WHERE PLANTS NEED IT

■ MANY TESTS SHOW listing is desirable in Great Plains corn production. It is efficient and conserves soil and water in contour farming. In that area, where rainfall is often limiting, yields from listing are at least as good as those from conventional methods.

Listed corn, however, starts slowly. The young plants are yellow and grow slowly after emergence. Stands are often poor and yields low with listed corn.

Although fertilizer isn't everything, properly placed starter fertilizer improves emergence and early-season growth. With most of the present equipment available, starter fertilizer is dropped in the lister furrow or placed in a shallow band close to the seed.

Take a common commercial two-row hard-ground lister planter with disk moldboards, for example. This machine drops the fertilizer in the lister row 2 inches to the side of the seed, placing it poorly—on the ground, 1 to 2 inches *higher* than the seed.

Tests show, however, that plants get to the phosphorus sooner and thus use it more efficiently when fertilizer is banded 1 to 2 inches to one side of the seed and 2 inches lower. This placement also prevents poor stands that result when nitrogen contacts the seed.

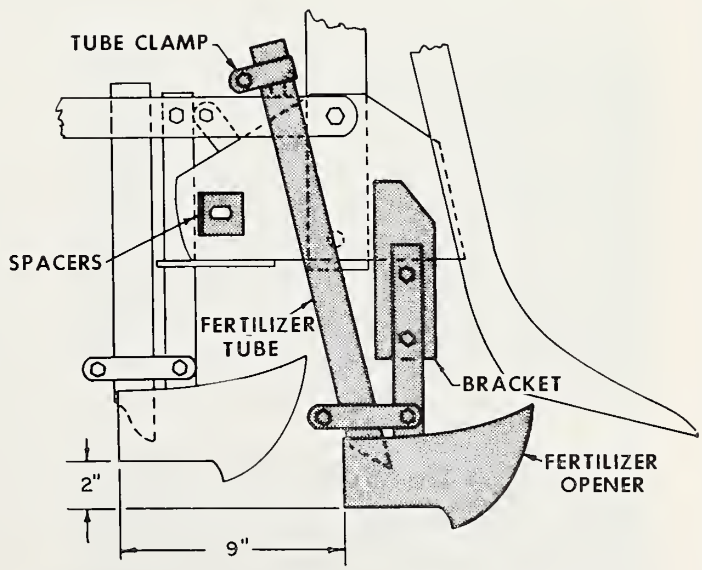
To accomplish this, USDA agricultural engineers R. J. Rowe and W. G. Lovely modified a common commercial planter at Iowa State College, Ames, in 1957. This machine places the starter fertilizer 2 inches to the side and 2 inches lower than the seed.

For banding, a short runner-type subsoiler similar to the seed furrow opener was mounted below and behind the lister point. The fertilizer opener was placed 9 inches ahead of the seed opener and 2 inches to the side, bolted to a bracket welded to the lister frame. The manufacturer's planting adjustment was unchanged and the fertilizer depth adjustment made to correspond.

When the seed unit was moved back 12 inches in early tests, the implement followed contour furrows poorly. But this was overcome when the unit was again made short from lister to seed-furrow closer, as in the original.

The first unit was used in Iowa in 1957, and listed corn showed good response. In 1958, three were tested in Iowa, one where listing is an accepted practice.

Detailed instructions for modifying a commercial two-row lister-planter are found in ARS 42-26, "A Lister-Planter Attachment for Side-Band Placement of Starter Fertilizer." This publication is available from Agricultural Engineering Research Division, ARS, U.S. Department of Agriculture, Washington 25, D.C. ☆



FERTILIZER opener was mounted under lister, 9 inches ahead of seed opener and 2 inches to the side and 2 inches below it.

LIFE UNDER THE SNOW

Forage grasses that sprout too early survive poorly, but herbs with swollen buds lie ready for spring growth

■ "IN THE DEAD OF WINTER" is a colorful phrase, but winter is not as dead as it may seem. USDA scientists found life beneath 8-foot snow in Utah's Wasatch Mountains.

The heavy blanket of white protects and nourishes. Animals cut activities only slightly, making undersnow cities and conducting business as usual. Meantime, seeds for next summer's grass are sprouting.

Just when seeds are planted in mountain meadows has a critical effect on their future. Seeds must be planted in time to take advantage of snow's protection and its meltings—the major source of water in the mountains.

Logically, deep snow protects soil from heavy freezing. In the winter of 1957–58, for example, air temperatures ranged between −2° and 56° F., while top soil temperatures were between 30° and 34° F. More severe topsoil temperatures were the rule, of course, at lower elevations that were not protected by snow.

For a clearer picture of the undersnow plant world, ARS range conservationist A. T. Bleak placed seeds of Manchar smooth brome, Tualatin oatgrass, and common tall oatgrass one-half inch below the surface—the Manchar and Tualatin on November 30, the common oatgrass and a second group of Manchar on January 4.

Season short in high plateau

Site of the test was Ephriam Canyon in Utah's 10,000-foot Wasatch Plateau, where snow comes in October, stays until June. Frost is gone only 87 days a year and the growing season is about 145 days.

To approximate early fall planting, which gives seed a chance to germinate but not develop emerging shoots, Bleak pregerminated several lots in each group and put them into the ground just before snowfall to simulate planting at the time researchers now believe optimum. This allows germination under protection of the permanent winter snow. Here's what Bleak found: Plantings that had a chance to germinate before winter were apparently more susceptible to winterkill than seeds planted just before first permanent snow.

For example, pregerminated Manchar smooth brome—with 95.4 percent germination by test—showed no germinating progress when removed from under 31 inches of snow. Germination was only 2 percent on February 4 and only 6.1 on May 13.

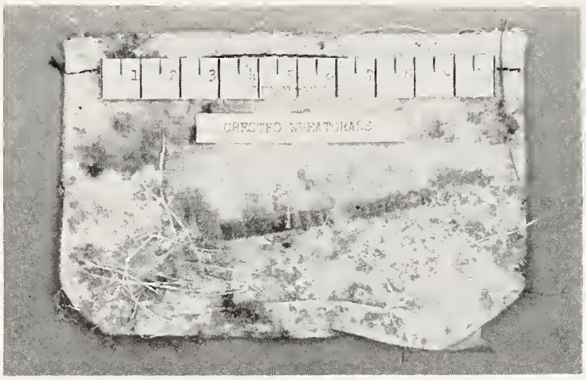
Further evidence of severe weather damage to pregerminated Manchar smooth brome is shown by the unfavorable germination range (in the laboratory): From 68.6 percent for that removed on January 4 down to 9.8 percent for seed excavated on March 5, and back up to 37 percent for seed left under snow until April 10. These compare unfavorably with an initial 95-percent germination when pretested.

In contrast, the unpregerminated seed also planted in late fall had germinated 1.5 percent by March 5 and 12.2 percent by May 13 where buried in the soil, and 86 to 90 percent in the laboratory after excavation.

Pregermination causes damage

The outcome was similar with Tualatin oatgrass, germination 12.6 percent. Pregerminated Tualatin, planted November 30, showed germinations from 0.6 percent (May 5 and 13 removals) to 2.2 percent (January 4 removal). The unpregerminated seed again fared better, germinating 1.6 percent under snow by April 10 but only 0.4 percent by May 13—and in laboratory tests from 13.2 percent on January 4 to 4.2 percent on May 13.

Common tall oatgrass (testing 89.2 percent) showed no germination until April 10, but 1.8 percent on that date



SHOOTS of pregerminated seeds (above) bagged and buried under the snow in early winter have persisted until March 24, when the batch was dug and photographed. Lush buds of Richardson geranium (in the lower photograph) typify the readiness of many herbs to break into growth in early spring.

and 19.4 percent on May 13. It had good viability under snow, ranging from a high 69 percent germination of seed dug up on April 10 to 66 percent on May 13.

To assure an accurate count, the seeds were buried in cotton bags, 100 to the bag. Cotton fabric does not interfere with germination—in fact, soil micro-organisms almost did away with most bags. One was found in the snowy burrow of a gopher.

Seeds grow under heavy cover

In an accompanying study, seeds of seven grasses were planted under a permanent winter snow cover on October 31, 1957. The snow was 2 inches deep at planting and had reached 6 inches on the morning of November 1. By February 24, snow was 54 inches deep and some seed of all seven grasses had germinated. Roots of some seedlings were over 1 inch long and some crested wheatgrass shoots were above ground. Just before spring melt, on May 22, 1958, more than 80 percent of the crested wheatgrass, slender wheatgrass, tall oatgrass, and mountain brome seed had germinated.

Established plants also grow under the white cover. In fall, when summer foliage is drying, many grasses and other herbs put out secondary growth that continues after snow, sometimes through the winter.

Buds form in the crowns of many herbs in the fall and live under winter snow to produce early spring shoots. Bulbs, tubers, and corms of some species produce roots and start growth in the fall. Some plants continue to grow and emerge under snow just before spring melt.

Animal life seems to quiet a little, however. Marmots and ground squirrels burrow in, and active animals such as mice live in timber and brushy areas in snow breaks. But pocket gophers live in the soil and dig a great deal in the winter. ☆

FLUORESCENT powders show up brightly under ultraviolet light in the parts of a rat's intestine where coccidia oocysts are located. S is stomach attachment and C, the cecum. Powders and cysts were fed to rat 2 hours earlier. Capsules hold fluorescent powders for testing calves or sheep.

TRACING COCCIDIA IN LIVESTOCK

■ A NEW TWIST to an old device is helping USDA animal scientists trace paths of coccidia oocysts in the digestive tracts of test animals inoculated with these protozoa. (Coccidiosis is a common but usually overlooked disease that weakens or kills calves under 6 months old.)

A combination of daylight fluorescent pigments—developed during World War II for signaling—and ultraviolet light did the trick.

Radioactive isotopes are, of course, commonly used for tracing chemicals. But their use requires specialized training and expensive equipment. In contrast, the pigments are easy to use and are safe, even in larger amounts than those used in the tests.

Powders of these brilliant-hued pigments, which for some reason adhere to the cysts, were suspended with them in milk and fed at intervals to rats. With ultraviolet light, the colors were found in various areas of the digestive tracts, showing location of the cysts.

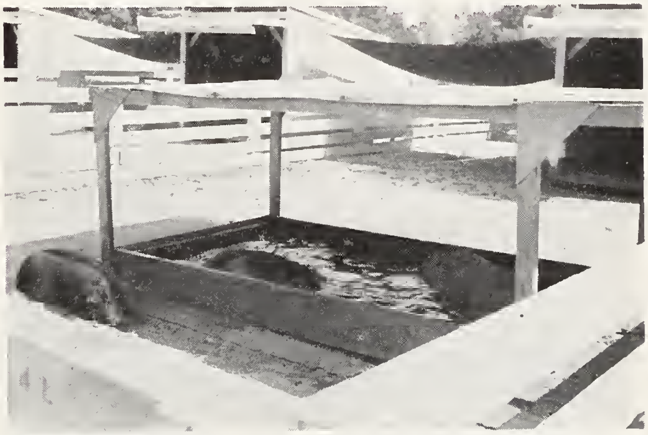
Colors were also detected in the digestive tracts of calves and lambs when the powders were mixed with bentonite, an absorptive compound, and given by capsule for several consecutive days—3 grams of pigment to calves and 2 grams to lambs. Two grams of the pigment given in a drench to a lamb showed up in the feces for 2 days, but on the third day could be detected only by ultraviolet light.

ARS protozoologists L. R. Davis and W. N. Smith of the Regional Animal Disease Research Laboratory, Auburn, Ala., suggest these pigments could differentiate feces of test and control animals. The pigments could also locate fecal contamination of soil by animals, and sites of injection of organisms, drugs, chemicals, and the like. ☆

No one can think hogs are fastidious, but in return for simple creature comfort,

Cool HOGS Gain Faster

HOT-WEATHER CHOICE was available to some of the hogs. They could lie in the shade under an airblast from the propeller fan at rear. Or they could get into water in wallow out in the sun.



SHADED WALLOW (above) was available to some hogs. Insulated, air-conditioned house (partly assembled, below) was used in part of the tests. One side panel is in foreground, and roof (in two convenient sections) at left. Cooled and slightly dehumidified air from water-cooled unit at left entered openings at rear of house.

■ AGRICULTURAL ENGINEERS are concerned about "missing" half pound. In cooperative State-USDA test hogs living outside under naturally varying conditio gained up to 1½ pounds daily. In contrast, test hog living under favorable conditions in a psychrometri chamber at the California Agricultural Experiment St tion. Davis, *consistently* gained 2 pounds daily.

Why the big difference? The engineers aren't sur But one of the approaches they're investigating to par down the difference is some type of outside protection o cooling that could enable hogs to gain faster.

Some kind of cooling is essential for hogs in ho weather because daily weight gains drop considerabl when temperatures reach 75° to 80° F. So far, howeve none of the cooling methods used in the tests enable hogs to put on that *extra* half pound. But the engineer did uncover some useful information on the comparativ value of several outside cooling systems.

Wallows as good as some expensive ways

For instance, ordinary wallows in the sun, long a familiar feature of hog raising, were found to be jus as effective in increasing rate of gain as some other ways that were more elaborate and expensive.

ARS and California scientists ran tests on 48 growing finishing hogs in temperatures ranging from 58° to 94° F. Cooling methods used included wallows in the sun and shade, wallows combined with increased air motion from a fan, part-time access to a small air-conditioned house, and confinement to a pen inside a large hogbarn. A control group of animals wasn't cooled at all.

All cooled animals gained weight more rapidly over the 70-day test. They averaged 1.43 to 1.51 pounds per day, compared to 1.30 pounds for animals not cooled.

There weren't any *significant* weight differences in hogs cooled by the various methods. Food utilization, however, was greatest in the group with access to the air-conditioned house, and lowest in the control group.

Cooling greatly reduces respiratory rate

Although cooling methods were about equally effective, there *were* some differences in respiratory rates. During the hottest part of the day, control pigs were breathing at a rate of 130 to 170 times a minute; pigs in the shaded wallow but not in the water, 45 to 75; pigs in the water of the shaded wallow, 25 to 45; and pigs in the water of wallows in the sun, 60 to 90.

For wallows in the sun and those in the shade, it was necessary to use 1,120 gallons of water for the 70-day test, to maintain 4 inches of water and for draining and cleaning purposes. For wallows with increased air motion, 1,230 gallons were necessary. ☆

Fumigating a drydock

A large wooden drydock in the ship channel at Houston, Tex., was recently fumigated under supervision of USDA entomologists to prevent spread of a destructive termite.

The termite (*Coptotermes crassus*) has not previously been found in this country but infests western Mexico, Honduras, and Guatemala. Closely related species cause millions of dollars in damage annually in the Canal Zone, Hawaii, and Australia.

The drydock and pier were covered with plastic sheeting with the ends weighted and dropped below water level to form an airtight seal. Then 20,000 pounds of methyl bromide was released into the 3½ million cubic feet of space enclosed.

Valued at $1.5 million, the huge drydock has been towed to many ports of the world and was used for ship repair during World War II. The termite infestation was confined to the drydock and a nearby pier, but the insects could have flown to surrounding areas in the winged stage and caused tremendous damage to wooden structures and trees.

Way to save carotene

A chemical that stabilizes carotene (provitamin A) in dehydrated alfalfa meal has been developed at USDA's Western Utilization Research and Development Division, Albany, Calif., in cooperation with State experiment stations and industry.

Licenses to use the chemical—designated EMQ—are being obtained by commercial processors under provisions of public service Patent No. 2,562,970. The U.S. Food and Drug Administration granted approval early this year for use of EMQ as an antioxidant additive in forage meals for poultry feed.

EMQ reduces the normal oxidation loss of 100 million units of carotene per ton of alfalfa meal to 30 million units per ton, a loss of about one-tenth the total content of 300 million. EMQ also preserves xanthophylls and vitamin E, both important for livestock nutrition.

Uniform distribution is obtained by spraying the chemical, dissolved in animal fat, on the alfalfa meal. In addition to serving as a solvent, the fat aids in maintaining the green color of fresh forage and reduces the dust from processing and handling.

New uses for wheat

New uses for wheat are coming from studies at USDA's Northern Utilization Research and Development Division, Peoria, Ill. Wheat flour, chemically modified so it mixes readily with water to form a free-flowing paste with less tendency to thicken and gel, can be used as a thickening agent, adhesive, and coating and size for paper and textiles.

The wheat may be treated by either of two methods—with ethylene oxide to produce hydroxyethylated flour or with propylene oxide to make hydroxypropylated flour. The resulting modified flours are similar.

Fever virus isolated

A virus that is one of the causative agents of shipping fever, a costly and prevalent respiratory disease of cattle, has been isolated by USDA veterinarian R. C. Reisinger and coworkers at USDA's Agricutural Research Center, Beltsville, Md.

The SF–4 virus (Para-influenza 3) was isolated from nasal mucus of calves showing signs of shipping fever. When this virus was sprayed into noses of healthy calves, they developed mild cases of shipping fever.

The SF–4 antiserum has no effect on the infectious bovine rhinotracheitis (IBR) virus, another virus isolated from calves with shipping fever, although in some instances SF–4 and IBR viruses produce similar symptoms and both seem to be part of the shipping fever complex.

A third virus has also been isolated from cattle with shipping fever but has not yet been classified.

Pasteurella (bacteria) were isolated from 65 percent of cattle in herds with shipping fever and from

PASTE POURS freely when made from hydroxypropylated flour (left) or hydroxyethylated flour (center). At right is untreated flour paste. Modified flour has many potential uses.

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half the cattle in herds without the disease. In some cases these bacteria cause a secondary infection that determines the severity of shipping fever.

Scientists at the National Institutes of Health found that SF–4 virus is serologically similar to a virus isolated from children suffering from respiratory diseases. But it was not determined that the SF–4 virus can cause these diseases in children, or that the virus from children can cause shipping fever in calves.

Reisinger thinks that the number of infectious agents isolated from cattle affected with shipping fever may some day be comparable with the number isolated from humans affected with respiratory infections.

Another pest spreads

The most abundant cattle fly in Ohio in mid-July was the *Musca autumnalis* Deg., an Old World relative of the common housefly. This pest, first found on this continent (Nova Scotia) in 1952, and in this country (Long Island) in 1953, shows how an imported insect can flourish and multiply in a new environment.

In Ohio, as many as 50 flies were found on one cow's face and flies averaged 100 per animal in Indiana, according to USDA Plant Pest Control Divsion reports. Other States are being surveyed to determine how large an area this pest has invaded.

The larvae develop in cowdung and other kinds of excrement. Pupation occurs in the soil around the excrement. Adults suck blood and other exudations coming from either natural openings or wounds in mammals. The flies cannot pierce the skin.

They like to feed and congregate in the sun, leaving animals when they enter barns or other shelters. But the adults hibernate in buildings.

Advisory groups meet

The 25 Research and Marketing Advisory Committees are holding their annual meetings for the 13th year.

The committeemen, representing all segments of U.S. agriculture, are appointed by the Secretary of Agriculture under provisions of the Research and Marketing Act of 1946. They offer guidance to USDA in planning research and service to improve production, marketing, and utilization of agricultural products.

First of the meetings was held by the Forest Research and Marketing Committee at Portland, Oreg., August 24–29. Other committees will meet as follows (in Washington, D.C., if location is not given):

November: 2–4, Food and Nutrition Committee; 2–5, Sheep and Wool, Albany, Calif.; 2–6, Sugar, Salt Lake City; 2–6, Citrus and Subtropical Fruit; 18–20, Rice.

December: 2–4, Home Economics Committee; 2–4, Seed; 7–10, Dairy; 7–10, Potato, Philadelphia; 16–18, Feed and Forage.

January: 4–7, Deciduous Fruit and Tree Nut Committee; 11–14, Grain; 11–14 Soils, Water, and Fertilizer, Athens, Ga.: 18–21, Poultry, Albany, Calif.; 25–27, Oilseeds and Peanuts; 27–29, Tobacco.

February: 3–5, Food Distribution Committee; 8–12, Vegetable; 9–12, Farm Equipment and Structures, Stoneville, Miss.; 15–18, Livestock; 23–26, Refrigerated and Frozen Products, Orlando, Fla.; 23–25, Transportation; 24–26, Economics; 24–26, Cotton and Cottonseed.

ADULT *Musca autumnalis* Deg. is larger than related housefly. Closely set eyes of male (left) almost meet. He has an orange-yellow abdomen with dark stripe down middle. Female (right) is similar to housefly. Mature larvae have characteristic yellow color.

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